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Binder Selection for Airfield Pavements

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so necessary.

Sustainability and Airfields

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- “The ability to provide for the needs of the world's current population without damaging the ability of future generations to provide for themselves. When a process is sustainable, it can be carried out over and over without negative environmental effects or impossibly high costs to anyone involved.”

- Asphalt pavement is the most sustainable material

- Must design and construct for long life to achieve maximum sustainable benefits

Why use Superpave?

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- Conversion from Marshall to Superpave is one key to extending pavement life
- Asphalt cement has been PG graded since about 1995 – soon it may not be possible to get CGSB Pen-Vis graded cement
- Superpave aggregate gradations are prevent from Ontario eastward and are starting to be used in the western Provinces

Superpave

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- Developed in response to pressures on the US highway system
- Strategic Highway Research Program (SHRP), authorized by Congress in 1987
- A highly focused, $150 million, 5-year effort designed to improve the performance of highway materials and highway maintenance practices with two subsequent extensions
- Adopted by all states within a few years (funded)

- On of the first products was the PG system for binder selection

PG Grading System

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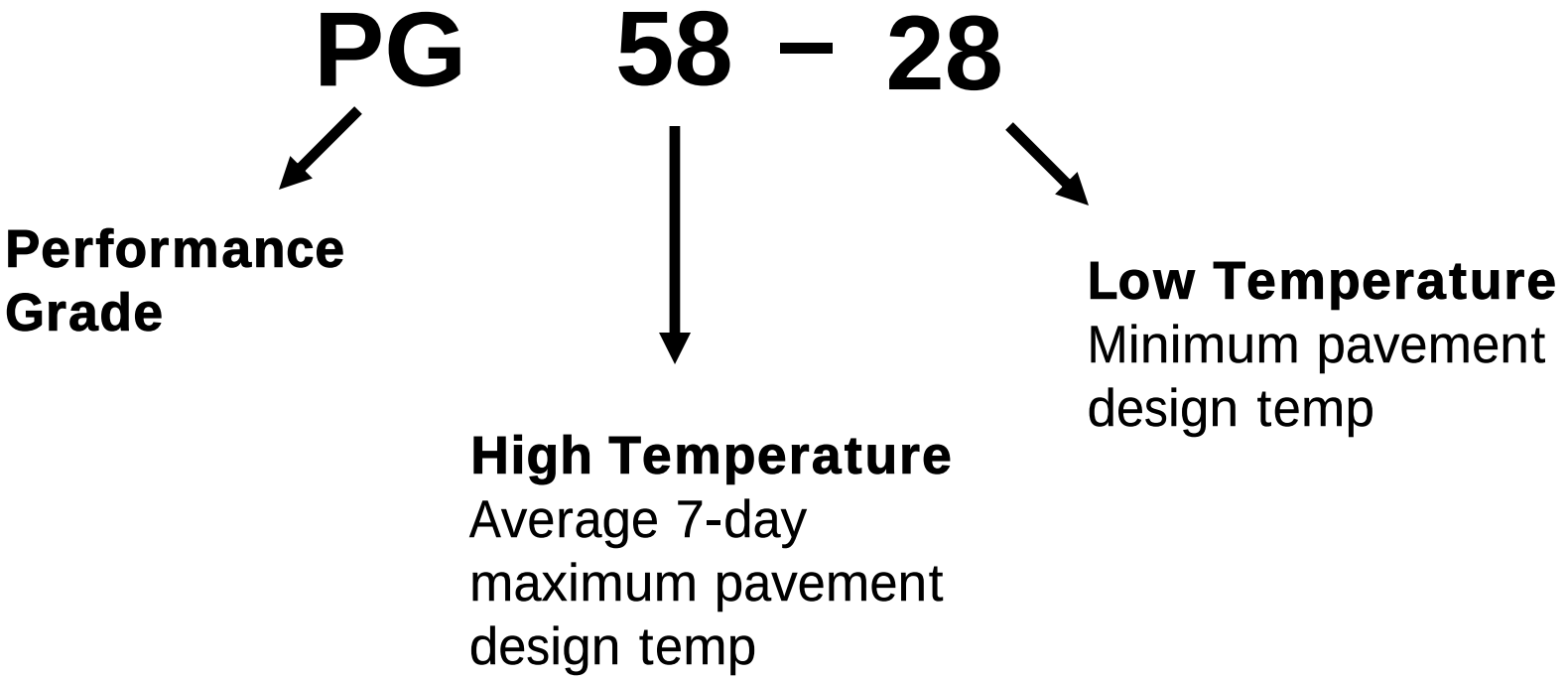

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Grade Bumping P-401

Aircraft Gross Weight (pounds)	High Temperature Adjustment to Base Binder Grade	
	Pavement Type	
	Runway	Taxiway/Apron
Less than 12,500	--	--
Less than 60,000	--	1
Less than 100,000	--	1
Greater than 100,000	1	2

NOTES:

1. PG grades above a –22 on the low end (e.g. 64–16) are not recommended. Limited experience has shown this to be a poor performer.
2. PG grades below a 64 on the high end (e.g. 58-22) are not recommended. These binders often provide tender tendencies.
3. PG grades above a 76 on the high end (e.g. 82-22) are not recommended. These binders are very stiff and difficult to work and compact.

Grade Bumping P-401 (SP)

Determine binder requirements from the LTTP Bind software using 98 percent reliability with no traffic or speed adjustments. Increase the high temperature grade by the number of grade equivalents indicated (1 grade is equivalent to 6 degrees C) below. Use the low temperature grade as determined from LTTP Bind. (see NOTES)

Aircraft Gross Weight (pounds)	High Temperature Adjustment to Binder Grade
	All Pavement Types
weight < 12,500	--
12.500 < weight < 100,000	1
weight > 100,000	2

NOTE: PG grades above a –22 on the low end (e.g. 64–16) are not recommended. Limited experience has shown an increase in block cracking with -16 or -10 grade asphalts.

LTPPBIND Software

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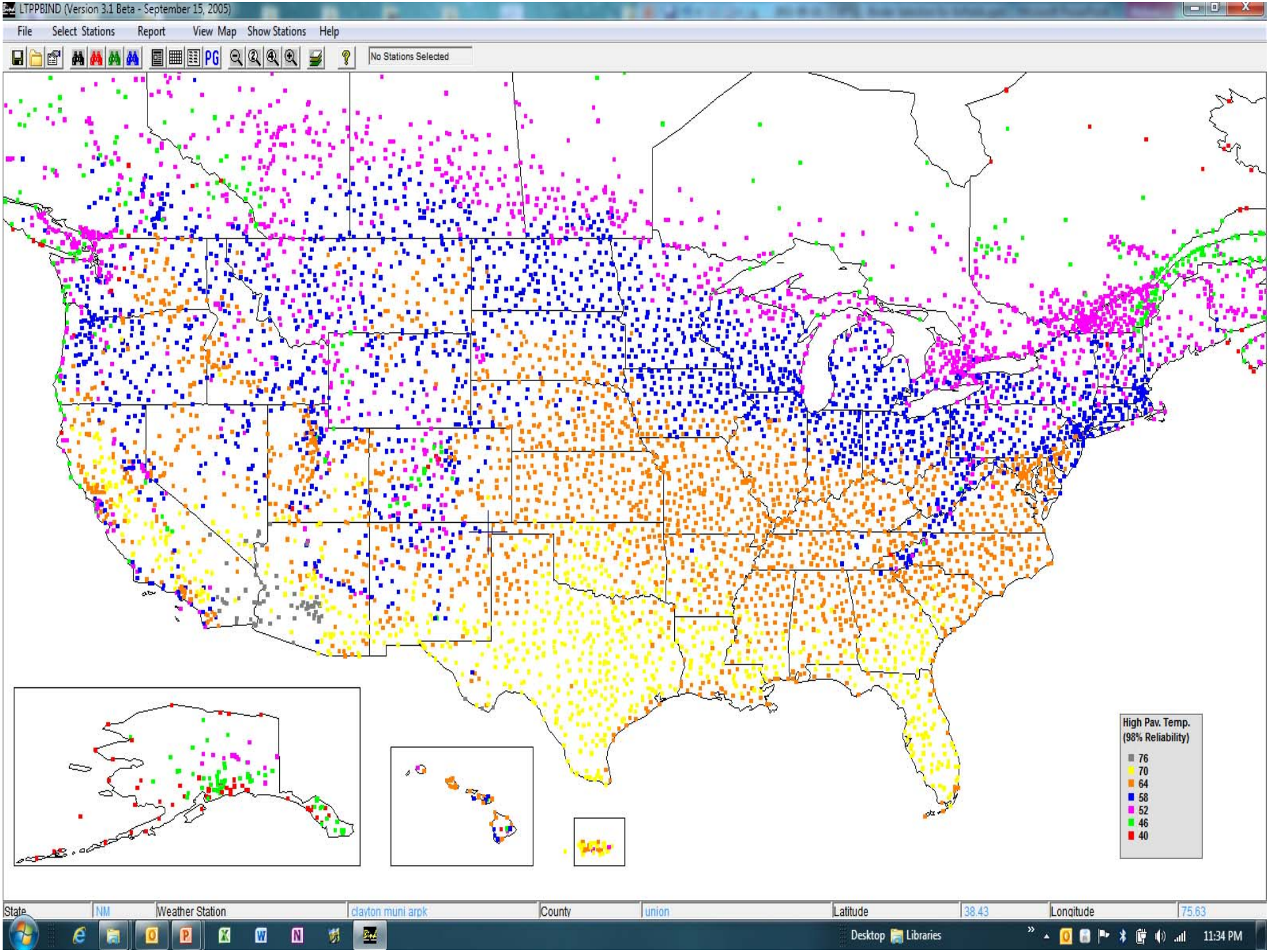
- Use LTPPBind to determine local environmental temperature
- Available free of charge
  - http://www.fhwa.dot.gov/pavement/ltpp/bind/dwnload.cfm
- Version 2.1 and 3.1 are both available on line
- For EB 59A and likely for AC 150/5370-10E dated Sept 30, 2009 (contains Item P-401(SP) approved for all runways and taxiways) still use LTPPBind 2.1


LTPPBIND (Version 3.1 Beta - September 15, 2005)
File
Select Stations
Report
View Map
Show Stations
Help
No Stations Selected
High Pav. Temp.
(98% Reliability)
76
70
64
58
52
46
40
State
NM
Weather Station
clayton muni arpk
County
union
Latitude
38.43
Longitude
75.63
Desktop
Libraries
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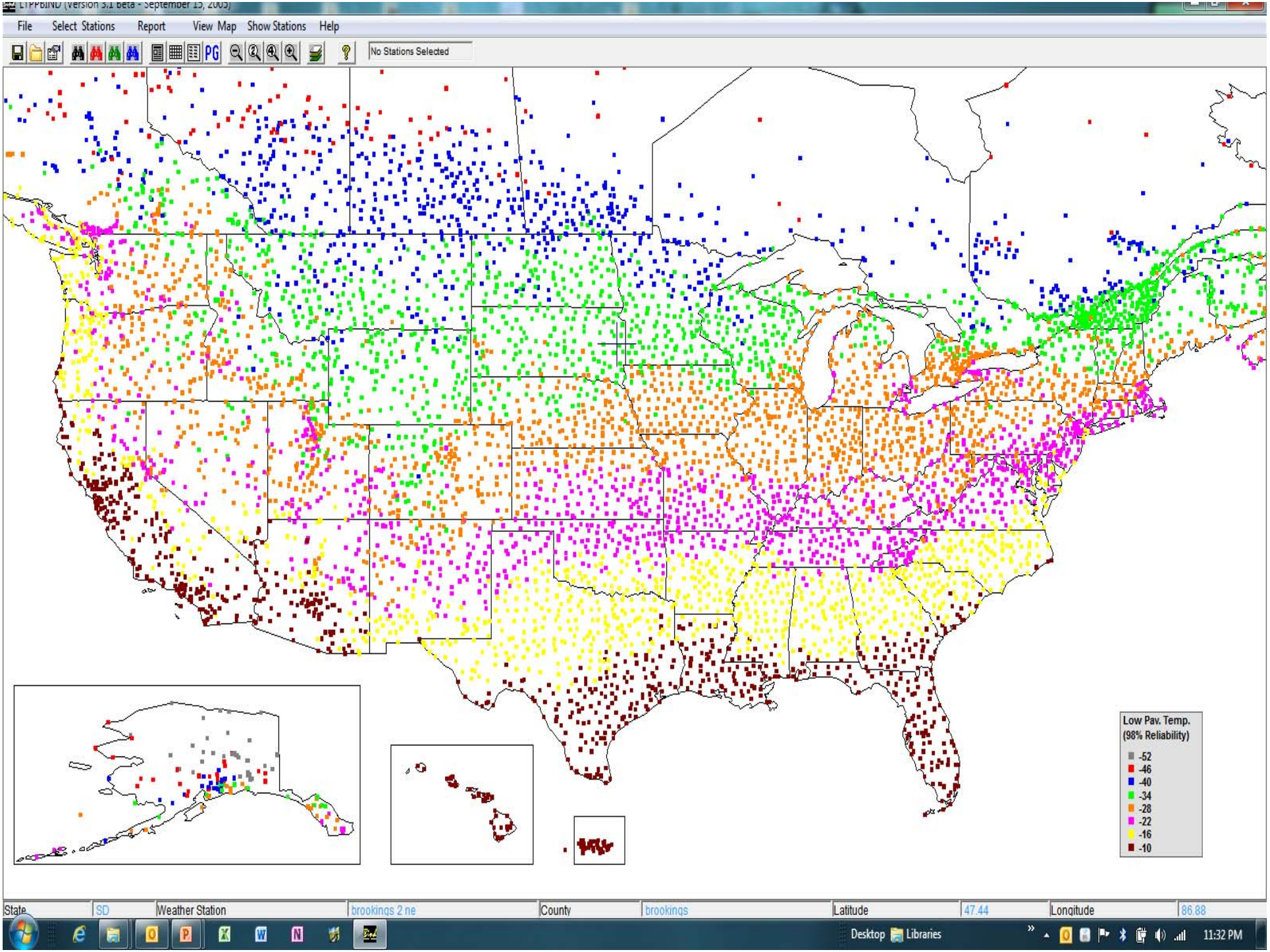
LTPPBIND (Version 3.1 Beta - September 15, 2005)
File
Select Stations
Report
View Map
Show Stations
Help
No Stations Selected
Low Pav. Temp.
(98% Reliability)
-52
-46
-40
-34
-28
-22
-16
-10
State
SD
Weather Station
brookings 2 ne
County
brookings
Latitude
47.44
Longitude
96.88
Desktop
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Airfield Asphalt Pavement Technology Program (AAPTP)

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- FAA sponsored Research program carried out at Auburn University
- Several research reports on using Superpave highway specifications for airport work
- Program was suspended in 2010

- Webinars and Full Reports still available online
  - www.aaptp.us

AAPTP Projects

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- Many very interesting research reports
- Binder selection
  - 04-02: *PGAC for Airfield Pavements*
  - Authors state that their recommendations are based on existing Superpave mix design procedures and if 04-03: *Superpave Mix Design for Airfield Pavements* makes significant changes, the recommendations should be re-evaluated
  - States that LTPPBind v3.1 should be used
- Consult full reports for details of recommendations

Grade Bumping for Airfields

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- Why do we grade bump?
  - Environmental high temperature recommendations in LTPPBind may not ensure against permanent deformation (rutting) under high wheel loading and/or slow moving traffic
  - Bumping, or raising the high temperature grade by one or two grades is a method of increasing performance
- Superpave grade bumping is based on ESALs (*Equivalent Single Axle Loads)* which were used in the ASHTO road test
- How do you convert from highway loading to airfield loading?

Grade Bumping

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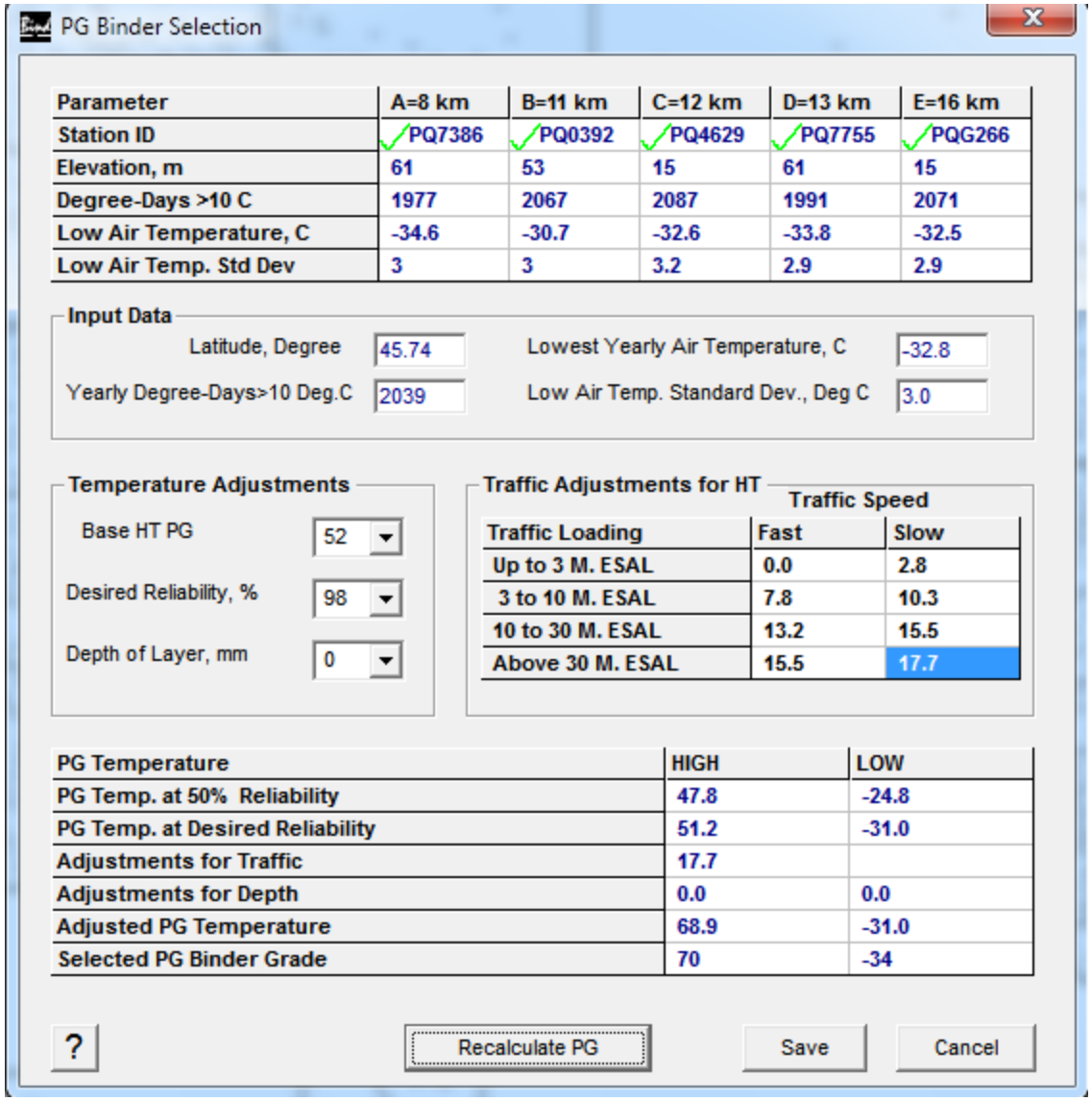

Parameter	A=8 km	B=11 km	C=12 km	D=13 km	E=16 km
Station ID	PQ7386	PQ0392	PQ4629	PQ7755	PQG266
Elevation, m	61	53	15	61	15
Degree-Days >10 C	1977	2067	2087	1991	2071
Low Air Temperature, C	-34.6	-30.7	-32.6	-33.8	-32.5
Low Air Temp. Std Dev	3	3	3.2	2.9	2.9

Input Data

Latitude, Degree	45.74	Lowest Yearly Air Temperature, C	-32.8
Yearly Degree-Days>10 Deg.C	2039	Low Air Temp. Standard Dev., Deg C	3.0

Temperature Adjustments

Base HT PG	52
Desired Reliability, %	98
Depth of Layer, mm	0

Traffic Adjustments for HT

Traffic Loading	Traffic Speed: Fast	Slow
Up to 3 M. ESAL	0.0	2.8
3 to 10 M. ESAL	7.8	10.3
10 to 30 M. ESAL	13.2	15.5
Above 30 M. ESAL	15.5	17.7

PG Temperature	HIGH	LOW
PG Temp. at 50% Reliability	47.8	-24.8
PG Temp. at Desired Reliability	51.2	-31.0
Adjustments for Traffic	17.7	
Adjustments for Depth	0.0	0.0
Adjusted PG Temperature	68.9	-31.0
Selected PG Binder Grade	70	-34

? | Recalculate PG | Save | Cancel

so necessary.

PG Binder Grade Selection for Airfield Pavements (04-02)

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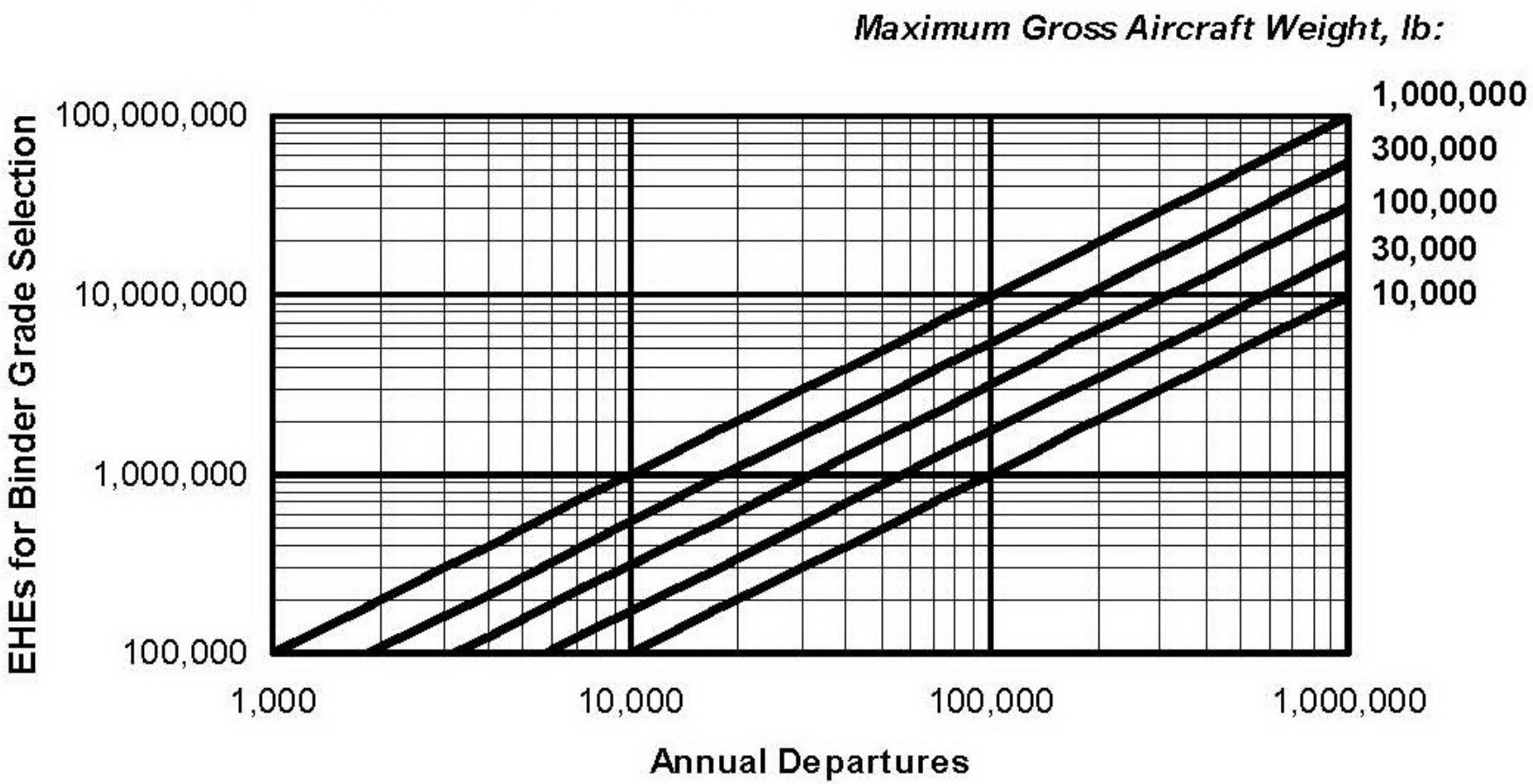
- Determine EHE (Equivalent Highway ESALs)
- Method of evaluating loading on airfield as compared to pavements
  - Tire pressure
  - Wander (Pass-to-Coverage Ratio)
- Developed recommendation in chart form

Equivalent Highway ESALs (EHE)



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Recommendations

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Table A. High-Temperature PG Grade Adjustments for Airfield Type and Aircraft Speed and Stacking, Including Provisions for Polymer Modified Asphalt Binders.

Aircraft Stacking	Typical Speed *Mph*		Design Traffic *EHEs*	Grade Adjustment *°C*	
	Runway Centers	Taxiways/ Runway Ends		Non-Modified Binders	Polymer Modified Binders*
None	≥ 45	15 to < 45	< 300,000	0	
Little or none	≥ 45	15 to < 45	300,000 to < 3 million	+7	*Not Required* +4
			3 million to < 10 million	+7	*Suggested* +4
			≥ 10 million	---	*Required* +4
Occasional	---	5 to < 15	< 10 million	+14	*Suggested* +11
			≥ 10 million	---	*Required* +11
Frequent	---	< 5	Any	---	*Required* +17

**Polymer modified binders must have a minimum elastic recovery value of 60 % at 25 °C, following procedures described in AASHTO 301.*

New Developments

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- MSCR (*Multiple Stress Creep Recovery)*
  - Tests only at the environmental temperature
  - "Bumping" based on loading
    - **S**tandard, **H**igh and **V**ery High (and **E**xtreme)
    - Uses Jnr – Non-recoverable creep compliance
  - M320 = PG 58-34 → PG 64-34 → PG 70-34
  - MSCR = PG 58-34S → PG 58-34H → PG 58-34V
- Second part of test – MSCR % Recovery
  - Indicator of polymer modification
  - Much better system than Elastic Recovery

More New Developments

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- Recently published AAPTP reports
  - 06-01: *A Laboratory And Field Investigation to Develop Test Procedures for Predicting Non-load Associated Cracking of Airfield HMA Pavements*
  - 06-01II: *Guide for Prevention and Mitigation of Non-load Associated Distress*
- Very recent publication presented this spring at the AAPT conference by Dr. Michael Anderson (AI Director of Research)
  - Based on research on unmodified asphalt cement grades
  - Needs research on modified grades
  - Needs more verification before implementation

AI Regional Engineer Offices and User Producer Groups

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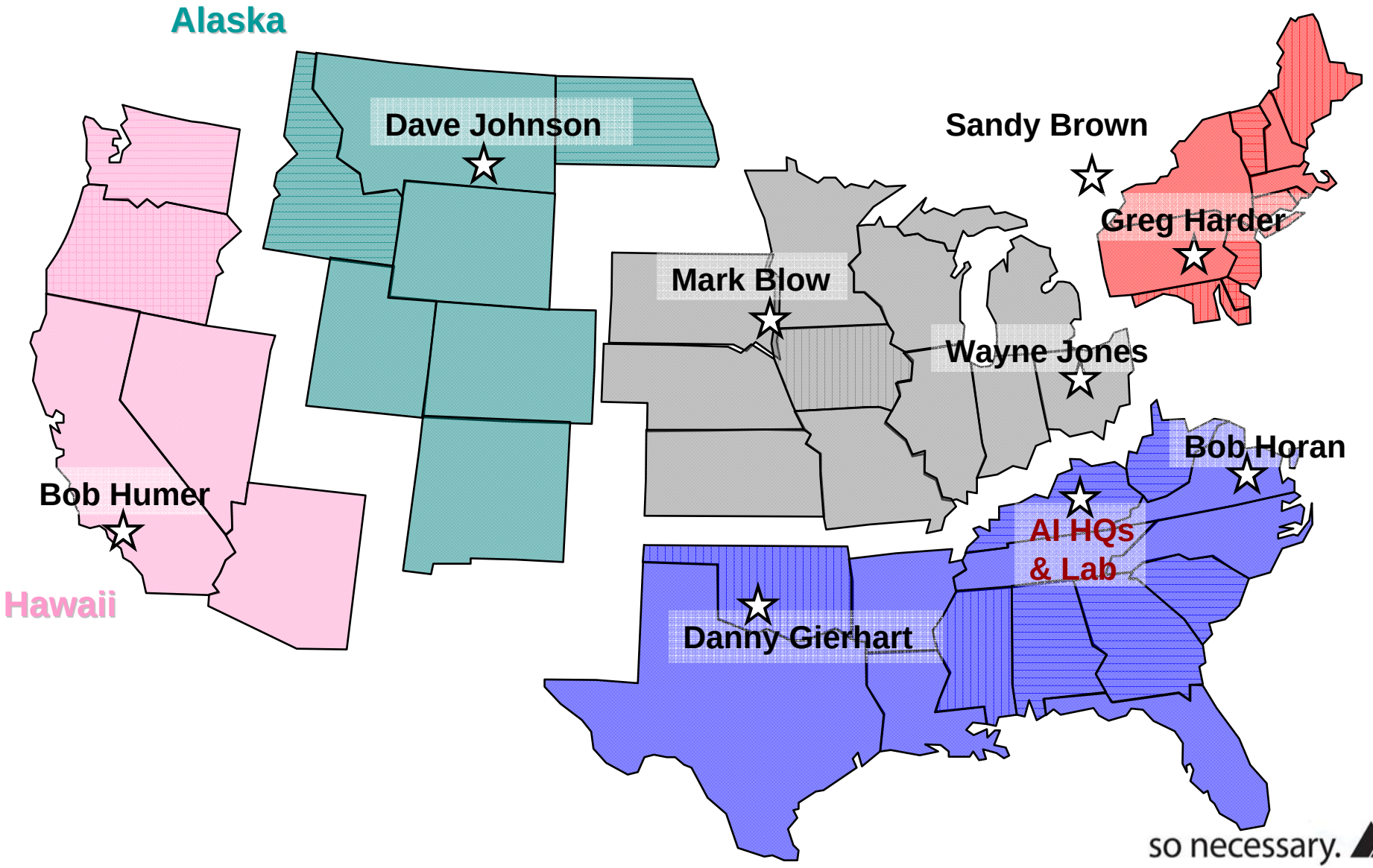

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A Fast Overview!

Thank You!